

WHAT IS CLAIMED IS:

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1. An optical deflection apparatus that changes a reflection direction of an incident light flux, the optical deflection apparatus comprising:

a member including a light reflection region; and

10 an electret member that contributes at least in part to a generation of an electrostatic attraction force, the electrostatic attraction force subjecting the member including the light reflection region to at least one of a displacement and a deformation.

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2. The optical deflection apparatus as claimed in claim 1,  
20 wherein:

the electret member is arranged to be in contact with the member including the light reflection region; and

an electric potential difference between an electric potential of the electret member and an electric potential applied to an electrode that is set apart and substantially

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opposite to the electret member causes at least one of a displacement and a deformation of the electret member and the member including the light reflection region.

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3. The optical deflection apparatus as claimed in claim 1,  
wherein the electret member and the member including the light  
10 reflection region are not electrically connected to an external  
potential.

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4. The optical deflection apparatus as claimed in claim 1,  
wherein the member including the light reflection region has a  
torsion beam configuration.

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5. The optical deflection apparatus as claimed in claim 1,  
wherein the member including the light reflection region has a  
25 cantilever beam configuration.

5       6. The optical deflection apparatus as claimed in claim 1,  
wherein the member including the light reflection region has a  
dual side fixed beam configuration.

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7. An optical deflection apparatus that changes a  
reflection direction of an incident light flux, the optical  
deflection apparatus comprising:

15       a substrate;  
            a plurality of regulating members having stoppers and  
being implemented at a plurality of edge portions of the  
substrate;  
            a fulcrum member being implemented on the substrate;  
20       a sheet member including a light reflection region and an  
electret member, and being movably disposed within a space  
created by the substrate, the fulcrum member, and the stoppers;  
and  
            a plurality of electrodes being implemented on the  
25       substrate and arranged substantially opposite to the sheet

member;

wherein the sheet member is subjected to at least one of a displacement and a deformation by an electrostatic force generated with respect to the electret member and the  
5 electrodes.

10 8. The optical deflection apparatus as claimed in claim 7,  
wherein:

the fulcrum member is arranged to divide the substrate substantially in half;

15 the electrodes are arranged such that a first electrode is implemented on one side of the fulcrum member and a second electrode is implemented on the other side of the fulcrum member; and

a one-axis two-dimensional optical deflection is realized by tilting the sheet member around the fulcrum member.

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9. The optical deflection apparatus as claimed in claim 8,  
25 wherein:

a first electric potential that is substantially equivalent to an electric potential of the electret member is applied to one of the first and second electrodes;

5 a second electric potential is applied to the other one of  
the first and second electrodes; and

the sheet member is tilted by switching between applying  
the first electric potential and the second electric potential  
to the first electrode and the second electrode.

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10. The optical deflection apparatus as claimed in claim  
9, wherein the second electric potential corresponds to a  
15 ground potential.

20 11. The optical deflection apparatus as claimed in claim  
7, wherein an inorganic material is used for the electret  
member.

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12. The optical deflection apparatus as claimed in claim  
11, wherein at least one of a metal oxide film, a metal  
oxinitride film, and a metal nitride film is used as the  
5 inorganic material.

10 13. The optical deflection apparatus as claimed in claim  
11, wherein a silicon oxide film is used as the inorganic  
material.

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14. The optical deflection apparatus as claimed in claim  
11, wherein a silicon nitride film is used as the inorganic  
material.

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15. The optical deflection apparatus as claimed in claim  
25 11, wherein an aluminum nitride film is used as the inorganic

material.

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16. An optical deflection apparatus manufacturing method,  
comprising the steps of:

forming a fulcrum member on a substrate;

forming a plurality of electrodes on the substrate;

10 depositing and planarizing a first sacrificial layer over  
the electrodes;

depositing an electret member on the first sacrificial  
layer;

15 charging the electret member to a predetermined electric  
potential;

depositing a member including a light reflection region on  
the electret member;

patterning the electret member and the member including  
the light reflection region to form a sheet member;

20 depositing a second sacrificial layer on the sheet member;

patterning the first sacrificial layer and the second  
sacrificial layer;.

patterning a plurality of regulating members having  
stoppers to a position where the first and second sacrificial  
25 layers are patterned; and

removing the patterned first and second sacrificial layers through etching.

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17. The optical deflection apparatus manufacturing method as claimed in claim 16, wherein an inorganic material is used for the electret member.

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18. The optical deflection apparatus manufacturing method  
15 as claimed in claim 17, wherein at least one of a metal oxide film, a metal oxinitride film, and a metal nitride film is used as the inorganic material.

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19. The optical deflection apparatus manufacturing method as claimed in claim 17, wherein a silicon oxide film is used as the inorganic material.

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20. The optical deflection apparatus manufacturing method  
5 as claimed in claim 17, wherein a silicon nitride film is used  
as the inorganic material.

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21. The optical deflection apparatus manufacturing method  
as claimed in claim 17, wherein an aluminum nitride film is  
used as the inorganic material.

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22. An optical deflection array that is adapted to change  
a reflection direction of an incident light flux, the optical  
20 deflection array comprising:

an optical deflection apparatus including a member having  
a light reflection region, and an electret member that  
contributes to a generation of an electrostatic attraction  
force, the electrostatic attraction force subjecting the member  
25 having the light reflection region to at least one of a

displacement and a deformation; wherein

a plurality of the optical deflection apparatuses are laid out in at least one of a one-dimensional arrangement and a two-dimensional arrangement.

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23. An optical deflection array that is adapted to change  
10 a reflection direction of an incident light flux, the optical  
deflection array comprising:

an optical deflection apparatus including a substrate, a  
plurality of regulating members having stoppers and being  
implemented at a plurality of edge portions of the substrate, a  
15 fulcrum member being implemented on the substrate, a sheet  
member including an electret member and a light reflection  
region, and being movably disposed within a space created by  
the substrate, the fulcrum member, and the stoppers, and a  
plurality of electrodes being implemented on the substrate and  
20 arranged substantially opposite to the electret member, the  
sheet member being subjected to at least one of a displacement  
and a deformation by an electrostatic attraction force  
generated with respect to the electret member and the  
electrodes; wherein

25 a plurality of the optical deflection apparatuses are laid

out in at least one of a one-dimensional arrangement and a two-dimensional arrangement.

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24. An imaging apparatus that is adapted to form a latent image by conducting optical writing on a photoconductor, the imaging apparatus comprising:

10       an optical write unit including an optical deflection array that is adapted to change a reflection direction of an incident light flux, the optical deflection array implementing an optical deflection apparatus including a member having a light reflection region, and an electret member that

15       contributes to a generation of an electrostatic attraction force, the electrostatic attraction force subjecting the member having the light reflection region to at least one of a displacement and a deformation, wherein a plurality of the optical deflection apparatuses are laid out in at least one of

20       a one-dimensional arrangement and a two-dimensional arrangement.

25       25. An imaging apparatus that is adapted to form a latent

image by conducting optical writing on a photoconductor, the imaging apparatus comprising:

an optical write unit including an optical deflection array that is adapted to change a reflection direction of an  
5 incident light flux, the optical deflection array implementing an optical deflection apparatus including a substrate, a plurality of regulating members having stoppers and being implemented at a plurality of edge portions of the substrate, a fulcrum member being implemented on the substrate, a sheet  
10 member including an electret member and a light reflection region, and being movably accommodated within a space created by the substrate, the fulcrum member, and the stoppers, and a plurality of electrodes being implemented on the substrate, and arranged substantially opposite to the electret member, the  
15 sheet member being subjected to at least one of a displacement and a deformation by an electrostatic force that is generated with respect to the electret member and the electrodes, wherein a plurality of the optical deflection apparatuses are laid out in at least one of a one-dimensional arrangement and a two-  
20 dimensional arrangement.

25 26. An image projection display apparatus that is adapted

to display a projection image based on image information, the image projection apparatus comprising:

a display unit that reflects an optical signal from a light source in a desired direction according to the image  
5 information, the display unit including an optical deflection array that implements an optical deflection apparatus including a member having a light reflection region, and an electret member that contributes to a generation of an electrostatic attraction force, the electrostatic attraction force subjecting  
10 the member having the light reflection region to at least one of a displacement and a deformation, wherein a plurality of the optical deflection apparatuses are laid out in at least one of a one-dimensional arrangement and a two-dimensional arrangement.

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27. An image projection display apparatus that is adapted to display a projection image based on image information, the  
20 image projection apparatus comprising:

a display unit that reflects an optical signal from a light source in a desired direction according to the image information, the display unit including an optical deflection array that implements an optical deflection apparatus including  
25 a substrate, a plurality of regulating members having stoppers

and being implemented at a plurality of edge portions of the substrate, a fulcrum member being implemented on the substrate, a sheet member including an electret member and a light reflection region, and being movably accommodated within a space created by the substrate, the fulcrum member, and the stoppers, and a plurality of electrodes being implemented on the substrate, and arranged substantially opposite to the electret member, the sheet member being subjected to at least one of a displacement and a deformation by an electrostatic force that is generated with respect to the electret member and the electrodes, wherein a plurality of the optical deflection apparatuses are laid out in at least one of a one-dimensional arrangement and a two-dimensional arrangement.